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C V RAMAN MEMORIAL LECTURE 1979
Some Aspects of Modern Field Ornithology

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I feel happy and honoured at being selected by the Indian National Science Academy for the award of the C V Raman Medal and for the opportunity thus provided to me for paying a tribute to the memory of that great scientist. Although working in different disciplines of Natural Science which, at normal level, have little direct contact with each other, Dr Raman had found a meeting ground through his unquenchable thirst for scientific enquiry by picking on a facet of ornithology which has always drawn the wonderment of naturalist and layman alike, namely the extraordinarily brilliant colouration of the plumage of many, mostly tropical birds, especially the unbelievable metallic iridescence seen in the feathers of such families as the Sunbirds of the Old World and the Humming Birds of the New. These colours, known as Structural Colours are, as you may know, produced largely by the incidence of white light upon structural peculiarities overlying pigments that are basically drab—what one may call pedestrian. Dr Raman's insatiable curiosity in this regard led to his pioneering studies on the brilliant colouration of Indian birds. I recall his frequent visits in those days—somewhere around the year 1926—to the cluttered museum of the Bombay Natural History Society, then located in the premises of Phipson & Co., the wine merchants, in order to rummage in our bird collection for suitable material for his research. I also recall vividly the illuminating discussions about birds in general we had on those occasions, and how impressed I was by the breadth of his knowledge of the subject that they revealed.

But to revert to today's talk: 'Some Aspects of Modren Field Ornithology'. Field Ornithology, as such, is a comparatively recent concept, having come into its own, as it were, between the two World Wars, and particularly since the end of the Second. But it had started as a weak current of purposeful bird-watching already before the turn of the century, and even gained some degree of respectability in scientific circles in England, Germany and the USA by the time of the 1914–18 war. Previous to this, ornithology was regarded as scientific only if it involved museum or laboratory work—taxonomy, morphology, anatomy, and so on. Hardboiled professional zoologists were inclined to look down on bird watching as merely a silly way of killing time by the idle rich. Even as lately as 1901 the eminent

American ornithologist Ridgway asserted that only anatomy and systematics constituted scientific; ornithologly life-history and habits was 'popular'. It is perhaps true that in the early days bird watching was, by and large, somewhat of an elitist exercise and treated as a prestigious eccentricity of a gentleman of leisure. Such was the condecending attitude of the average professional, or 'cabinet' biologist, towards bird-watching, notwithstanding the attainments of Darwin and Wallace which have so completely revolutionized biological thinking in the last 150 years. Although the theory of Natural Selection is not based wholly on a study of birds but of other animals as well, the fact remains that it was mainly the field study of birds—especially the food and feeding habits, and the consequential structural modifications among the Galapagos finches that implanted Darwin with the first primordial seed of the Natural Selection concept. In essence, therefore, this was the same as bird-watching, albeit on a higher scientific and intellectual plane. That is just what we now call Field Ornithology. Essentially it is nothing more than bird-watching with a purpose, freely spiced with ecology and ethology and reinforced by statistical quantification in the interpretation of the data. Formerly ornithological field work consisted chiefly of collecting specimens in different parts of the world to cater for the intramural research of scientists at home. Expeditions and adventurous field collectors travelling to far off countries vied with one another in amassing the largest number of skins, their main ambition being to discover and name, or have named after them, as many novelties as possible, or for lucrative sale of exotic material, especially from the tropics, to museums and private collectors. A time came when diminishing returns forced the realization on systematists that most of the major accessible areas of the world had been reasonably well explored, and practically all forms of birds properly identified and described. It then began to be increasingly appreciated that the naming of birds and arranging them neatly into Orders, Families, Genera and Species, and thereafter in museum cabinets, was not enough; that it was important also to know how the birds lived—their habits, food, nesting, etc.—in other words their ecology which included elementary behaviour studies until the latter developed and flowered as a full-fledged discipline of its own, termed ethology. Ethology has been well defined as the study of habits in relation to habitats. It has now come to mean the study of function, biological significance, causation and evolution of species-typical behaviour. Oscar Heinroth was perhaps the pioneer of the modern concept of ethology in Germany and Julian Huxley in England, but as understood today ethology may really be said to date from the publication in *Journal für Ornithologie* of Konrad Lorenz's epoch-making paper 'Der Kumpan in der Umwelt des Vogels'. (The Companion in the Bird World) in 1935. Therefore it is a comparatively young science, but during the last 20 years or so it has made spectacular progress with close cooperation among ecologists, physiologists and psychologists, the last of whom were once its strongest critics. Personally, my main area of interest in birds has been their ecology, a study which can be undertaken only in the field. Among the many advantages of such a study is the fact that it normally needs no costly gadgets, and is therefore within the range of the average amateur. It depends for success entirely on the keenness, dedication and resourcefulness of the researcher himself. But in recent years remarkably sophisticated researches on bird migration have been achieved with the aid of high-power radar which has enabled the continuous monitoring of the movements, direction, height and volume of migrating birds by day and night throughout the year.

On account of the pleasure men have derived from watching birds in their natural environments, birds enjoy the distinction of being the most studied class of animals. Thus they have provided the most important material for animal behaviour studies and the bases for many biological theories and concepts. It may be recalled that the two recent Nobel Prize winners in biology, the ethologists Niko Tinbergen and Konrad Lorenz, started off their careers as simple amateur birdwatchers.

Another great advantage of studying birds in the field is that unlike mammals and many other creatures which are mostly on the move after dark, the majority of birds are active during daytime and can be observed with ease. The availability of comparatively inexpensive prismatic binoculars—the only indispensable tool--has added immeasurably to the facilities for purposeful bird-watching. It needs to be supplemented only with a notebook and pencil, and an ample stock of patience and dedication for any serious amateur to tackle fairly complex problems of bird biology. As an example, and with due modesty, I may perhaps cite my own definitive studies, as long ago as 1930, on the breeding biology of the Indian Baya or weaver bird (*Ploceus philippinus*), carried out entirely with this simple equipment plus a suitable camera for supporting evidence. The resulting new interpretation of the weaver bird's nesting behaviour, tested and retested, has since received general acceptance and set the stage for much consequential refined and sophisticated ethological studies by other workers in this country and abroad. Not the least advantage of working with birds rather than with, say, primates, is that keeping them in captivity as controls is usually comparatively easy since they can be provided with conditions close enough to Nature not to distort their natural behaviour too much. Ethological investigations are now regarded of such vital consequence because they not only further scientific knowledge of the behaviour of all kinds of animals, but a proper interpretation of the results helps us to understand the behaviour of man himself.

Harking back to my own sorry experience when after completing the formal zoology studies I wished to specialize in ornithology and found that no university or institution in India was equipped for imparting such training, I was fortunate in successfully persuading the University of Bombay in 1959 to recognize the Bombay Natural History Society with its unequalled library facilities and bird collection as a guiding institution for postgraduate research in Field Ornithology. The Society has established a fund, known as the Salim Ali-Loke Wan Tho Ornithological Research Fund, which for the present is capable of supporting only two fellows at a time for two to three years. They are working in the field on various problems of bird ecology and bionomics for M.Sc. and Ph.D. degrees in Zoology. Most of the products of this scheme—two M.Sc.'s and five Ph.D.'s so far —have done excellent work, demonstrating that with proper facilities and guidance India can produce ornithologists of a calibre second to none. So far, our students have experienced little difficulty in getting professionally absorbed as university zoology teachers or in various wildlife organisations where personnel specially trained in field biology are badly needed. There is also a demand for trained field ornithologists in the various agricultural universities where research in Economic Ornithology has recently been started, and it is expected that the demand will grow as the benefits of such research become better appreciated.

In recent years the activities of field ornithologists, both amateur and professional, have expanded to such an extent, and cover so vast a spectrum of topics—ranging from simple straightforward recording of observations to profound statistical theses

bordering almost on the abstruse—that it is physically impossible for even a full-time worker to keep track of even a fraction of the literature that is being churned out at increasing tempo in the ever proliferating scientific and popular ornithological publications. I shall presently give you a random sample of the contents of recent issues of some of our leading international periodicals in the English language just to give you an idea of the current trends in the study of birds. Well over 60% or even 70% of the topics deal with ecology and ethology. And besides the English periodicals there is of course a vast array of other specialist or semi-popular journals and magazines published in almost every advanced country of the world and in a welter of languages—German, French, Hungarian, Polish, Italian, Russian, Chinese, Japanese and more recently also Arabic and Farsi—each bursting at the seams with a varied assortment of topics bearing on the ecology and ethology of birds. In India we have as yet no journal devoted exclusively to ornithology because of the comparative paucity of popular interest in birds and of serious bird-watchers as well. In the last hundred years or so the *Journal of the Bombay Natural History Society* along with *The Ibis*, which is the organ of the British Ornithologists' Union, has carried all the more important papers on Indian ornithology contributed mostly by British officials in the country. Since the Second World War, and particularly after Independence, there has been a refereshing spurt of interest in natural history among Indians, and a number of periodicals have appeared like the *Journal of the Zoological Society of India*, the *Cheetal* and others of a more parochial and often ephemeral character which sometimes carry articles on diverse aspects of Indian birds of widely varying quality.

I shall give the titles of some randomly picked papers on Field Ornithology as mentioned earlier, and describe their contents briefly for your information.

Seed Density, Cover, Predation and Distribution of Birds in a Beechwood in Southern Sweden

The distribution of six common birds whose preferred food is beech seeds were analysed in two winters when beech seeds were abundant, to determine whether food was a sufficient factor to explain the distribution of bird flocks within the habitat. It was found that cover was inversely correlated with seed density. The most important consumers were the Wood Pigeon (*Columba palumbus*) which took 44% of the total seeds consumed by birds, and the Brambling, *Fringilla montifringilla* which took 33%. The latter species sometimes occurs in flocks of millions of birds and seems specially adapted for feeding on beech seeds. The proportion of the total seed crop consumed by the birds was estimated at 4.5%, which was probably more than the amount consumed by mammals. [Sven G Nilsson, *The Ibis*, **121** (2), April 1979]

Factors affecting the Egg Size of Red-billed Gulls (*Larus novaehollandiae scopulinus*)

This was an investigation to establish whether egg size—length, breadth and volume—is an important factor determining survival after hatching in this gull, as is the case in some other birds. Influence of factors such as date of laying, food abundance, age, status of the pair-bond, and the weight of the female, on the egg size were studied at a breeding colony in New Zealand where nestlings had been banded in previous years and whose ages were therefore accurately known. In 2-egg and 3-egg clutches there was a tendency for the eggs to become smaller in the sequence of laying. The egg-size showed no direct correlation with the availability

or abundance of food. The largest eggs were produced early in the season when food was in short supply because the early layers were more efficient in foraging for food than the later layers. There was a trend for females to lay larger eggs when mated with older rather than younger males. Eggs laid by 2-year old females were significantly shorter. The breadth and volume of the eggs increased with the age of the female up to the 5th year. The author suggests that the seasonal decline in egg-size and clutch-size results from a decrease in the availability of food and the ability of the individual to exploit the resource. But whether clutch- and egg-sizes are directly related to availability and abundance of food, or have an ultimate adaptive significance needs to be worked out particularly with populations of birds of known ages. [J A Miller, *The Ibis* **121** (1) January 1979]

Social Organisation and Nest-building in the Forest Weaver Birds of the Genus *Malimbus* (Ploceinae)

This study compares the social behaviour during the breeding season of African *Ploceus* species inhabiting open savanna country with *Malimbus* species which are forest dwellers. Although the genera are very closely related with very similar morphology and behaviour they inhabit contrasting biotopes and therefore, if ecology determines social structure, marked differences would be expected between the social organization of *Ploceus* species and *Malimbus* species. The study which is the result of about 200 hours of observations at breeding colonies on the behaviour of 6 sympatric species of *Malimbus* during the reproductive cycle, produced new and unexpected data which throw light on the probable behavioural evolution in the genus *Malimbus* from the ancestral stock of open country weavers. In one species of *Malimbus* the male chooses the nest site and builds the nest alone. In another the female assists the male in building the nest. In two other species the nest is built by one female who seems to be the leader assisted by a multi-male party of two or three all working together. In another species the very elaborate nest is built by the breeding pair helped by a party of 1–4 other males in full breeding plumage all working together without overt leadership. The pattern of the chores of incubation, breeding and feeding the young also varies among the species. Analysis of nesting behaviour suggests that the species in which the male alone builds—as is the case in our Indian Baya—is the least evolved, while those that build in bisexual parties are behaviourily the most evolved. [A Brosset, *The Ibis* **120** (1), January 1979]

Comparative Foraging Efficiencies of some Montane Sunbirds in Kenya

This study attempts to asses the interaction between the benefits and costs of foraging that determines which foraging tactics will be employed and which food items will be chosen by an animal since its ability to obtain food depends strongly on its feeding apparatus, while the efficiency with which it forages depends also on the costs associated with obtaining the food Foraging behaviour and efficiency influence an animal's division of its time and energy budget, which in turn may affect survival and reproductive success. Ultimately such partitioning may effect co-existence and patterns of competition among species that exploit the same food resources.

The field studies were carried out in Kenya with four sunbirds (*Nectarinia* spp.) typical of montane non-forest habitats, which fed on the nectar of the bright orange tubular flowers of mint (*Leonotis nepetifolia*) suitable for insertion of the sunbirds' slender specially adapted bills. The relative length

and curvature of the bill in the different species and of the corolla of the flowers affects not only the ability of the bird to reach the nectar chambers, but more importantly the actual rate of nectar intake. By a cleverly improvised formula the foraging cost and rate of net caloric gain was calculated for each species and it was shown that differences in the bill dimensions of these sunbirds affected both the rate of nectar extraction and the proportion of available nectar that is removed from the flower. The results were consistent with the apparent fit between the bills and the length and curvature of the corolla. Differences in body size of the birds affect foraging costs and render the species more similar, but not equivalent, with respect to rates of net caloric gain at the *Leonotis* flower. [Frank B Gill & Larry L Wolf. *The Condor*, **80** (4), Winter 1978].

Very little work has been done in India on Ornithophily, which means the fertilization of flowers by nectar eating birds. It is a subject that has always held special interest for me, and one of my post-graduate students has recently done some very excellent field research in it. Her thesis entitled 'Synecological studies on specialized nectar-eating birds and bird-flowers in the Nilgiris' has been accepted by the University of Bombay for a Ph.D. degree in Zoology.

Effects of Timber Harvesting on Breeding Birds in a Mixed-Coniferous Forest

The purpose of this investigation was to assess the differences in individual avian species-densities, species occurrence, and diversity values in a virgin mixed-coniferous forest and in a recently harvested one in Arizona where most of the trees forming the canopy were removed. The aim was to determine how birds were affected by logging and whether selective harvesting retained avian diversity. The study involved the composition and densities of bird species in virgin mixed-coniferous forests and in logged areas, the foliage volume profile in these contrasted areas, and the bird species occurrence, breeding density and species diversity in the same. A comparative study was made of changes in the number and distribution of breeding bird species and densities between the years according to their methods of foraging in the unlogged and logged plots. It was found that the harvested plot held far fewer tree-foliage searching species while the density of timber-gleaning species and those that nested in foliage was significantly greater in the unlogged plot. The birds that usually nest in tree holes and forage mainly on live vegetation and bark were significantly less abundant in the logged plot, whereas woodpeckers which forage both on live and dead trees were equally abundant in both plots. Aerial foragers, as well as birds that feed in slash benefitted by the lumbering. Selective felling led to an increase in the diversity of tree species but no appreciable change in bird species. Nevertheless while containing approximately the same number of bird species, the modified plot supported a far smaller total population. The virgin forest provided substantially more foliage volume and configuration than the logged plot, thus exerting a strong influence on avian species-composition and densities because of the nesting sites and foraging substrate available. [Kathleen E Franzreb and Robert D Ohmart, *The Condor* **80**(4), Winter 1978].

This sort of field studies are of special relevance in our own country today, where vast tracts of rich diversified natural forest are being destroyed for replacement by monoculture of commercial timbers, like eucalyptus, teak and sal, to the detriment of the species-diversity and population densities not only of birds but of all other wildlife inhabiting them as well.

Geographic Variation in the 'Hoy' Call of the Bobwhite

The study of individual variation in avian vocalizations attempts to define the limits of variation for single populations, failing to address the dimensionality of the species. The author believes that only through detailed analyses of intraspecific variation can the systematics of a species be approached. He attempts to discern geographic variation in the vocalization of four populations of the American Bobwhite Quail *Colinus virginianus* within its vast contiguous range, through multivariate analysis of quantitative morphometric characters of sonograns of one of its calls. This quail provides a particularly suitable material for study of geographic variation of vocalizations on account of its wide continuous range through much of the U.S. and Mexico, wherein several subspecies are recognized on the basis of slight morphological and colour variation. This implies a degree of genetic isolation among the contiguous populations. The call of the Bobwhite was tape-recorded in the field at four locations at the extreme periphery of its farflung range. Fifteen characters were measured for one call of each of the 38 birds recorded, for examination of the various elements of the call by elaborate statistical techniques. In spite of the absence of qualitative differences apparent dialects were detected for the four populations. The study showed, moreover, that dialects exist among populations on a mosaic pattern rather than one associated with any geographic cline. Unlike morphological characters which are genetically transmitted, accoustical characters may also be the result of learning. [Raymond B Goldstein, *The Auk* **95**(1), January 1978].

That dialects do exist also in the calls of Indian birds with a far-flung contiguous distribution will have been evident to any discerning bird watcher who has had occasion—readily provided now-a-days by air travel—to compare the call of the northern subspecies of, say, the Redvented Bulbul with the population found in Kerala, but these audible differences have not been statistically analysed.